

## DETAILED ACTION

### EXAMINER'S AMENDMENT

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Attorney Brian L. Stender on 03/05/2010.

2. The application has been amended as follows:

#### **In the Claims**

##### **In claim 9**

At the end of line 3, after "work-piece," insert -- each work-piece having a face, --.

In line 4, after "region" delete "of" and insert -- on --; and after "work-piece" insert -- face, -- before "wherein"; and after "the" insert -- friction stir welded -- before "region".

At the end of line 5, after "work-piece" insert -- from an exterior surface of each work-piece, and each friction stir welded region having a grain structure that is finer than the grain structure of the work-piece outside the friction stir welded region -- before ",".

At the beginning of line 6, replace "preparing" with -- machining --; and also after "welded", replace "regions" with -- region --.

At the beginning of line 7, before "surface" insert -- prepared --.

In line 9, after "respective" replace "pieces" with -- work-pieces --.

**In claim 10**

At the end of line 3, after "work-piece," insert -- each work-piece having a face --.

In line 5, after "region" delete "of" and insert -- on --; and after "work-piece" insert -- face, the friction stir welding-- before "resulting".

At the beginning of line 6, before "extending" insert -- of each work-piece; and after "from" delete "the" and insert -- an --; after "into the" insert -- respective -- before "work-piece" and then insert -- , and the friction welded region of each work-piece -- before "having".

In line 8, after "region," replace "and" with -- aligning the two work-pieces so that the friction welded regions abut, and --.

***Allowable Subject Matter***

3. Claims 9, 10, 12, 13, 15, 16, and 22-31 are allowed.
4. The following is an examiner's statement of reasons for allowance: The closest Prior arts of record comprises: the Patent to Litwinski et al. (US 6,726,085), Mishra et al. (US 6,712,916) and Forrest et al. (US 6,398,883). Litwinski et al. teaches a friction stir welding method of mixing the surface of a metal workpiece to form a perform having a refined grain structure; Mishra et al. teaches a friction stir welding method of forming a metal perform by stirring at least a segment of a single piece of bulk metal to impart superplasticity thereto; and Forrest et al. teaches friction stir welding method of

preparing segments of workpieces to impart grain refinement thereto and then secure said workpiece to each other by welding or fastening. However these prior art of record considered either individually or in combination fails to teach the claimed sequence:

In claim 9: friction stir welding a region on each work-piece face, wherein the friction stir welded region extends only part way into the workpiece from an exterior surface of each workpiece, aligning the friction stir welded regions of the respective pieces so that a friction stir welded region abuts another friction stir welded region, and fusion welding the respective prepared surfaces of the two work-pieces together such that a fusion welded region of the work-pieces that melts during the fusion welding process is at least partially encompassed within the friction stir welded regions of the work-pieces, thereby joining the work-pieces.

In claim 10: friction stir welding resulting in a friction stir welded region of each work-piece extending from an exterior surface only part way into the respective work-pieces, and aligning the two work-pieces so that the friction welded regions abut, and welding together the work-pieces by means of a fusion welding process that joins the respective prepared portions of the two work-pieces, wherein the friction stir welded region of each work-piece extends into the work-piece to a depth that exceeds the depth of material that is caused to melt during the fusion welding process such that a fusion welded region of the work-pieces that melts during the fusion welding process is at least partially encompassed within the friction stir welded regions of the work-pieces.

In claim 22: friction stir welding at least one region of each of said two or more work-pieces thereby producing a friction stir welded region extending from the exterior

surface of the work-piece into the work-piece by a first distance; arranging said two or more work-pieces so that the substantially flat surface of each of said two or more work-pieces resulting from skimming abuts the substantially flat surface of another of said two or more work-pieces; fusion welding the abutting substantially flat surfaces, thereby joining the work-pieces together to form a block of metal, the fusion welding causing material in the friction stir welded region of each work-piece to melt to a second distance extending into the work-piece, the second distance being less than the first distance such that a fusion welding region of the work-pieces that melts during fusion welding is encompassed within the friction stir welded regions of the work-pieces.

In claim 23: providing two metal work-pieces; preparing the work-pieces by applying a friction stir welding process on the at least one face of each work-piece, the friction stir welding process defining a friction stir welded region extending a first distance into the work-piece from the plane of the at least one face; arranging the work-pieces so that the at least one face of one work-piece abuts the at least one face of the other work-piece at a butt joint; and then welding the two work-pieces together at the butt joint with a fusion welding process wherein a portion of the friction stir welded region of each work-piece is melted, thereby defining a melted region extending into each work-piece a second distance from the plane of the at least one face of each work-piece, and wherein the first distance is greater than the second distance such that the melted region is encompassed within the friction stir welded regions of the work-pieces and so that a remaining portion of the friction stir welded region of each work-piece is

sandwiched between the melted region and the portion of the work-piece outside the friction stir welded region.

The claimed invention differs from the cited references in that, while they teach forming a grain refined area either on a segment or on the entire surface of a workpiece, they lack the teaching of aligning the friction stir welded regions of the respective pieces so that a friction stir welded region abuts another friction stir welded region, and fusion welding the respective prepared surfaces of the two work-pieces together.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

### ***Conclusion***

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHAEL ABOAGYE whose telephone number is (571)272-8165. The examiner can normally be reached on Mon - Fri 8:30am - 5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy King can be reached on 571-272-1244. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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